(No Model.)

H. SAWYER.

ELECTRIC ARC LAMP.

No. 469,093. Patented Feb. 16, 1892.

Fig. 1.

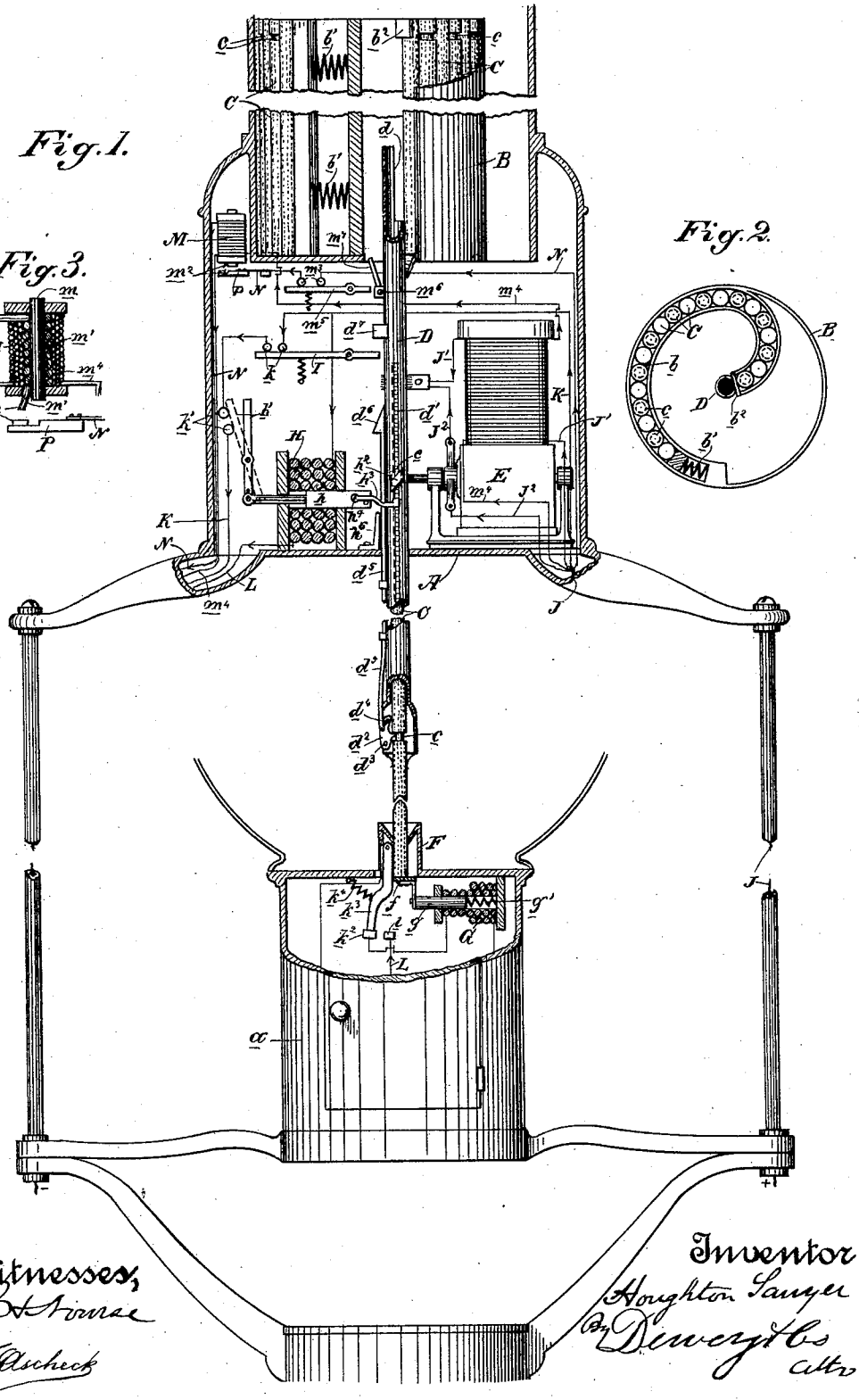

Fig. 3.

Fig. 2.

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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 469,093, dated February 16, 1892.

Application filed February 24, 1891. Serial No. 382,670. (No model.)

To all whom it may concern:

Be it known that I, HOUGHTON SAWYER, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Electric-Arc Lamps; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of lamps known as "electric-arc lamps;" and it consists, essentially, in a lamp containing a magazine for holding the upper and lower carbons, which carbons, by suitable means, may be thrown successively and respectively into a pair of carbon-holders, as required.

It also consists in the novel construction and arrangement of the magazine, the carbon-holders which receive the carbons from the magazine, and the devices for releasing the burned carbons and introducing and holding a fresh pair of carbons, as will be hereinafter fully described, and specifically pointed out in the claims.

The object of my invention is to provide what may be termed a "magazine arc lamp," automatic in its action and capable of carrying a number of carbons and supplying them successively to a pair of holders, whereby a light may be had for an indefinite period of time without having to replenish the carbons by personal attention.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a vertical section of my lamp. Fig. 2 is a top view of the magazine. Fig. 3 is a cross-section of the cutting-out magnet.

A is the frame of the lamp, having at is lower portion a receptacle *a* for the burned carbons. The upper portion of the frame of the lamp carries a magazine B, consisting of a casing having within it a groove or channel *b*, in which are placed a number of carbons C side by side and vertically arranged. A spring *b'* in one end of the groove or channel acts against the series of carbons and tends to continually press the foremost carbon out to the open or discharge end of the groove. Instead of by a spring, the series of carbons may be fed forward by gravity. The foremost carbon is, however, held in position until properly released by a small lip or flange b^2 at the upper end of the open end of the groove and by the body of the upper-carbon holder at its lower end, as will be presently described. The grooves shown at *c* in the upper ends of alternate carbons are for the purpose of receiving the locking devices, by which said carbons are held in the upper holder.

D is the upper-carbon holder consisting of a hollow bar or tube. The upper end of this carbon-holder is cut away at *d* to form a half-round portion open at the side, through which the carbons find an entrance. The carbon-holder extends up into the magazine and is in connection with the open end of the groove or channel *b* in said magazine. The full-round body of the holder serves to keep the foremost carbon back.

The carbon-holder D has a rack d' on its side, with which a pinion *e* or other device engages, said pinion being operated by an electric motor E, which first raises the carbon-holder to its highest limit and then gradually feeds it down to keep the arc established, as in ordinary cases. In the lower end of the carbon D is a locking-lever d^2, pivoted at d^3 and having its upper end guided by a slot and pin d^4. A rod d^5 is connected with this locking-lever and extends upwardly to and is connected with a lug d^6, adapted to slide slightly upon the upper portion of the carbon-holder. This locking-lever fits into the groove *c* at the upper end of the upper or positive carbon and holds it in the holder.

F is the tubular or hollow lower-carbon holder adapted to receive the lower or negative carbon. The lower carbon is supported in this carbon-holder by means of a sliding bottom *f*, adapted to traverse its lower portion. This bottom is connected with the core *g* of a solenoid G, and when said solenoid is energized, whereby it draws inwardly its core, the bottom *f* is removed from under the carbon-holder F and the contained carbon is allowed to drop through into the waste-receptacle *a* below. A spring *g'* serves to force the core *g* out again.

H is a solenoid above, having a core *h*, which is thrown in the path of the lug d^6, heretofore described, just before said lug reaches it.

I is a pivoted lever, one end of which lies in the path of a lug d^7 on the upper-carbon holder.

J is the main circuit from the positive terminal.

J′ is the primary circuit around the motor-field and through the carbons.

J^2 is a path of proper resistance through the armature of the motor and through the carbons.

K is a second circuit, which is broken at points k k, against which one end of the lever I is adapted to operate. It is again broken at the points k' k', and is closed at these points by means of a pivoted lever h', operated by the core of the solenoid H. This core is temporarily held back to break the circuit at k' k', and allowed to close it when proper by the fall of the upper-carbon holder, with which said core is connected by a curved cam h^2 and an arm h^3. The object of this will be presently described. This second circuit includes the lower solenoid G, and has a contact at k^2, against which a switch-lever k^3 is adapted to come in contact, said lever being pivoted to the lower-carbon holder and acted on by a spring k^4, which normally tends to throw it over into contact with the point l of a third circuit L, which said third circuit includes the upper solenoid H.

m^4 is a shunt-circuit between terminals, the current of which passes about the motor-field in the opposite direction to the primary circuit J′ and about the core of the cutting-out magnet.

M in Figs. 1 and 3 is the cutting-out magnet having armature P. This magnet has two separate coils wound around a stationary core m. The coil m' next to the core consists of a large conductor of low resistance and of few turns in shunt between terminals and broken at points m^2 m^2 and m^3 m^3. Surrounding this and wound in the same direction is a small conductor m^4 of high resistance and many convolutions, also in shunt between terminals containing in its circuit the coil of fine wire in the motor-field. The points m^3 m^3 are operated on by a lever m^5, which lies in the path of a movable cam m^7, pivoted at m^6 on the carbon-holder D.

The operation of the lamp is as follows: When the carbons already in the carbon-holders have been consumed sufficiently, arm h^3 comes in contact with cam h^2 and the core h is drawn in against the action of the solenoid and the circuit closed at points k' k'. Following this the lug d^7 on the upper-carbon holder D comes in contact with the pivoted lever I, thereby causing its other end to come in contact with points k k and close the second circuit K. The current of this circuit, passing around solenoid G, causes its core g to be drawn farther within its coil, and this core moves the bottom plate f of the lower-carbon holder from under said holder, thereby letting the lower carbon fall into the burned-carbon receptacle a below. As the circuit through the carbons is now broken, there is a rush of current in shunt between terminals and around the short-circuiting magnet M, causing the armature P to be drawn toward the core m, making the contact-points m^2 m^2 to meet and complete the circuit, thus short-circuiting the lamp. The lamp is short-circuited at each change of carbons. As the circuit through the carbons is not broken, the motor which is a part of this circuit loses its lifting-power. Thereupon the upper-carbon holder and carbon by reason of their weight move toward the lower-carbon holder, the upper-carbon holder entering it a short distance. This carbon is thereupon released by the lug d^6 coming in contact with the core h of the upper solenoid, and said lug being thereupon arrested. While the carbon-holder D moves farther down, the locking-lever d^2 is pulled upon by the rod d^5 of the lug, thereby releasing the upper carbon and allowing it to drop down through the lower-carbon holder into the waste-receptacle below. This downward movement of the upper-carbon holder is not, however, sufficient at this time to allow its half-round and open upper end d to get below the foremost one of the series of carbons, so that the carbons are still held in place by the full round body of the holder. The refuse of the upper carbon sliding through the lower-carbon holder follows so quickly after the release of the lower carbon that the switch-lever k^3 is kept forced over against the contact k^2 of the second circuit K, thus keeping it closed, the result of which is that the sliding bottom f of the lower-carbon holder is kept by the solenoid G to one side and said holder is kept open. After the two burned carbons have fallen into the receptacle there is nothing to hold the switch-lever k^3 in contact with point k^2, and thereupon the spring k^4 throws it over into contact with the point l, thus opening the second circuit K. As a result, no current passes around solenoid G and the spring g' within said solenoid causes the core to be projected and to force the sliding bottom f under the lower-carbon holder. As the switch-lever k^3 is now in contact with the point l, the third circuit L is closed, and the current passing around the upper solenoid H causes its core h to be withdrawn into it, which frees the lug d^6 and allows the upper-carbon holder D to move farther down and to bring its half-round portion d into connection with the foremost of the series of carbons C in the magazine above. At the same time this movement of the core of solenoid H breaks the circuit K at the points k' k'. As the carbon-holder is now at its lowest position, d^6 rests upon an immovable block h^6 and is kept raised an amount sufficient to keep lock d^2 open, making a clean channel in the upper-carbon holder for the reception of the fresh carbons from the magazine. The foremost carbon C, which is a negative carbon, now falls from the magazine into the half-round portion of the upper holder D, and sliding down through said holder enters the lower-carbon holder and is supported and locked

therein. A second carbon—this time a positive one—falls immediately, but is a moment later in descending, during which time the motor is receiving a rush of current, due to the low resistance of the circuit through the carbons, and raises the upper holder an amount sufficient to prevent the falling of another carbon from the magazine into the half-round upper end *d* of the upper-carbon holder. The motor continues raising the carbon-holder until the groove *c* in the carbon reaches the lock, when the locking-lever falls into it. The carbons are then pulled apart and the arc established. In the downward motion of the carbon-holder the movable cam m^7, pivoted at m^6, comes in contact with lever m^5 and is pressed in against the carbon-holder without effecting the position of the lever. In this position cam m^7 continues in its downward course with the carbon-holder until it no longer impinges against the arm of the lever m^5, when it falls from the upright position into its normal one. As the holder moves upward, the lever m^5 lies in the path of cam m^7 and is carried with it until turned an amount sufficient to allow the free passage of said cam when lever m^5 turns back into its normal condition, again completing the circuit at m^3 m^3. This accomplishes the momentary break in the circuit at m^3 m^3. During the rise of the carbon-holder D a movable arm h^3, pivoted at h^4, comes in contact with cam h^2 on the carbon-holder and is lifted and turned until out of the line of action of said cam, when it drops again into its horizontal position against pin h^5. The core *h* is unaffected by this operation, the operation of the solenoidal core *h* being accomplished by the downward motion only of the cam h^2 against the arm h^3. The circuit through the carbons being broken during the change of carbons, the lamp is cut out—that is, the main current is allowed to pass through a path N of low resistance around the carbons. When the fresh carbons from the magazine are thrown in, the resistance of the circuit through them is such as to allow a current to pass whose strength is sufficient to cause the motor to raise the carbon-holder, making cam m^7 come in contact with lever m^5 and break the short circuit. If the lamp gets out of order, the short circuit acts as in ordinary lamps—that is, to cut out the defective lamp without affecting others supplied by the same current.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric-arc lamp, a magazine for containing upper and lower carbons, a pair of carbon-holders, and means for feeding the carbons from said magazine into said pair of carbon-holders respectively and successively as required, substantially as herein described.

2. In an electric-arc lamp, a magazine for containing upper and lower carbons, a pair of carbon-holders, and electrically-operated mechanisms for feeding the carbons from said magazine to said holders respectively and successively as required, substantially as herein described.

3. In an electric-arc lamp, a magazine for containing upper and lower carbons, a pair of hollow or tubular carbon-holders, and automatic means for feeding the carbons from said magazine into said holders respectively and successively as required, substantially as herein described.

4. In an electric-arc lamp, the combination of a magazine containing a series of upper and lower carbons, a pair of tubular or hollow carbon-holders, and automatic mechanisms for feeding the carbons from said magazine respectively and successively into the carbon-holders and locking and releasing them, substantially as herein described.

5. In an electric-arc lamp, the combination of a magazine containing a series of upper and lower carbons, a pair of hollow or tubular holders, and means for feeding the carbons respectively and successively from the magazine into the holders, consisting of an electric motor, electric circuits, locking and releasing devices, and intermediate electrically-operated devices for operating the holders and the locking and releasing devices, substantially as herein described.

6. In an electric-arc lamp, the combination of the magazine having the groove or channel in which the series of upper and lower carbons are located and from which they are fed successively, and the tubular movable carbon-holder having an entrance at its upper end adapted to receive the carbons respectively and successively as it is brought down into communication with their lower ends, substantially as herein described.

7. In an electric-arc lamp, the combination of the magazine having the groove or channel in which the carbons are located and from which they are fed successively, and the vertically-movable tubular carbon-holder having a half-round portion at its upper end with an open side adapted to be brought into communication when lowered with the lower end of the carbons successively, whereby they enter said holder, substantially as herein described.

8. In an electric-arc lamp, the hollow or tubular carbon-holder having the sliding bottom *f*, in combination with the solenoid and its core connected with the sliding bottom, and an electric circuit, including the solenoid, substantially as herein described.

9. In an electric-arc lamp, the combination of the magazine carrying the series of carbons, the vertically-movable tubular upper-carbon holder adapted to receive said carbons successively, the tubular lower-carbon holder having a sliding bottom, and the means for automatically operating the upper-carbon holder, and the movable bottom of the lower-carbon holder, consisting of the electric motor having the primary circuit, the second

circuit K with its several contact-points controlled by mechanisms operated by solenoid cores and by the movement of the carbon-holder and carbons, and the third circuit L for breaking the second circuit and allowing the closing of the bottom of the lower-carbon holder and the raising of the upper-carbon holder, substantially as herein described.

10. In an electric-arc lamp, the cut-out magnet having the separate coils and circuit broken at two points, the armature P, controlling one of said points, the lever controlling the other, and the cam m^7 on the movable carbon-holder for operating said lever, substantially as herein described.

In witness whereof I have hereunto set my hand.

HOUGHTON SAWYER.

Witnesses:
ROBT. A. MORRISSEY,
CHAS. HENDERSON.